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Nonlinear optical properties of transition metal nanoparticles synthesized by ion implantation

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Abstract

Composite materials containing metal nanoparticles (MNPs) are now considered as a basis for designing new photonic media for optoelectronics and nonlinear optics. Simultaneously with the search for and development of modern technologies intended for nanoparticle synthesis, substantial practical attention has been devoted to designing techniques for controlling the MNP size. One of the promising methods for fabrication of MNPs is ion implantation. Review of recent results on ion-synthesis and nonlinear optical properties of cupper, silver and gold nanoparticles in surface area of various dielectrics as glasses and crystals are presented. Composites prepared by the low energy ion implantation are characterized with the growth of MNPs in thin layer of irradiated substrate surface. Fabricated structures lead to specific optical nonlinear properties for picosecond laser pulses in wide spectral area from UV to IR such as nonlinear refraction, saturable and two-photon absorption, optical limiting. The practical recommendations for fabrication of composites with implanted MNPs for optical components are presented.